A., works an installation of 137 electric lights, for which he formerly used a steam engine; as a result he finds that he effects a saving of more than 50 per cent.

According to Lord Kelvin, wind still supplies a large part of the energy used by man. Out of 40,000 of the British shipping, 30,000 are sailing ships, and as coal gets scarcer "wind will do man's work on land, at least in proportion comparable to its present doing of work at sea, and windmills or wind motors will again be in the ascendant."

THE FRANKLIN KITE CLUB AND JAMES SWAIM.

In the American Journal of Science for 1837, Vol. XXXII, pp. 304–307, there is an article by James Swaim (b. 1816, d. 1877), describing some observations by himself, made October and November, 1836, for the purpose of determining daily the height of that layer of electrified air "whose positive electricity was concentrated enough to expand the leaves of the electrometer." Such measurements would of course determine the height of a layer having a constant difference of potential with regard to the earth's surface at the lower end of the wire. Mr. Swaim used a kite and apparatus which he describes as follows:

The preceding experiments were made with common three-stick kites, two feet six inches long and two feet four inches wide, tapering from the middle to the top. Wire No. 30 was used, which was wound on a reel four feet in circumference, having a glass axle running on a frame about three feet high, which was made in the same manner as the one used by the Franklin Kite Club of Philadelphia.

An electrometer was connected with an iron ring through which the wire passed, and which was suspended by means of silk in front of the reel for the purpose of preventing the wire from running off in winding up rapidly.

Also an instrument was used for finding the height of the kite, which I constructed in the following manner: Two stationary arms of different lengths were placed at right angles. The longer of these was graduated into small equidistant divisions. A movable arm, which was graduated in the same manner, was attached to the short arm, into which was let a level. This instrument was attached to the front of the reel stand by means of a screw, on which it could move.

The height of the kite was found by means of a simple proportion. Mr. Swaim also publishes the meteorological observations made by him at the surface of the earth, concerning which he says:

The dew-point was found from the following formula, discovered by Mr. Espy: Take two thermometers (Fahrenheit) that agree, or allow for the difference; cover one of the bulbs with a wet rag and suspend them in the shade where there is a draft of air, or fan them briskly until they become stationary. Then the difference of the thermometers being multiplied by one hundred and three, the product divided by the number of degrees indicated by the wet bulb, and the quotient subtracted from the number of those indicated by the dry one, will give the dew-point.

From the above we infer that wire was used both by the Franklin Kite Club before 1836, and by Mr. Swaim in that year. The "three-stick kites" described by him are sometimes called "house kites," and have the form of an irregular but symmetrical hexagon.

The reference to Espy's use of the "whirled psychrometer" is important as confirming the conclusion long since published by the Editor, that Espy was the first who practiced this use of the instrument.

KITES IN AMERICA AND EUROPE.

The active meteorologists of to-day with their abundance of scientific periodicals do not easily realize the difficulties under which our ancestors labored a century ago. Before the establishment of Silliman's American Journal of Science, 1818, and the Franklin Journal, or the Journal of the Franklin Institute by Dr. Jones in 1826, Americans necessarily looked to England and France for the records of the progress of science. The journals that were most widely circulated among us were Tilloch's Philosophical Magazine, Nicholson's Journal of Natural Philosophy, Phillip's Annals of Philosophy, Brewster's Edinburgh Journal of Science, and Young's Quarterly Journal of Science, and in these we must search, not only for American contributions, but also for the articles that stimulated American workers and the ideas that were prevalent among them. The modern application of the kite to meteorological work illustrates very prettily this interchange of ideas between Great Britain and America. Franklin and his electric kite of 1748 were but tales of the past when, in 1825, the memoir of Prof. Alexander Wilson (which had lain neglected for thirty-six years among the papers of his son, Prof. Patrick Wilson) was published in the Transactions of the Royal Society of Edinburgh, and almost at the same time was largely reprinted in Thomson's Annals of Philosophy for November, 1826 (apparently the last volume before the Annals were united with the Philosophical Magazine). An abstract of this paper was published as promptly as possible in the Franklin Journal for March, 1827, Vol. III, p. 182, and must have at once fallen into the hands of Espy, who was at that time studying meteorological matters. About this time, also, he must have read Fisher's article in the Quarterly Journal for 1826, and soon began his own experiments with kites. He must, also, have seen Harvey's article in the Encyclopedia Metropolitana in 1834, as that encyclopedia was widely circulated in the United States. Espy's theories as to atmospheric currents and storms, the temperature of the air, and the formation and heights of clouds, supported as they were by his own observations with kites and those of the Franklin Kite Club, excited much attention in Europe between 1835 and 1845. The discussions on his theories preceded, if they did not directly lead to, the attempt of Birt and Ronalds in 1847 at the Kew Observatory to determine the real condition of the atmosphere above us as to temperature and moisture. Their experiments were given up as unsatisfactory and the kite seems to have been abandoned—if I may except some observations of my own in 1867 at Washington and 1876 at Atlantic City and those of Van Rysselbergh in Belgium in 1880—until Archibald began his valuable work in England in November, 1883. The scanty use made of the kite during this interval resulted very largely from the fact that the balloon had absorbed attention and, indeed, seemed at first to offer all the facilities needed for the exploration of the upper air. Afterwards balloon work was supplemented by the establishment of mountain stations, beginning with Mount Washington, 1870, and Pikes Peak, 1873. But the progress of dynamic meteorology had shown the need of regular observations from stations that are more perfectly isolated from terrestrial influences than is possible on a mountain top. The Eifel tower seemed to perfectly respond to our needs, but such towers are expensive and rare. A few isolated investigations by no means respond to the needs of dynamic meteorology. The work done with balloons, kites, and mountain stations was reviewed in my lectures of 1882–85, showing that we must have maps of the upper isobars, isotherms, and winds and, to this end, must increase the number of our mountain stations and stimulate the use of balloons. In June, 1885, Mr. McAdie used kites to study atmospheric electricity at Blue Hill in extension of his studies under Professor Trowbridge at Cambridge. In my official estimates of July, 1885, and September, 1886, respectively, I included "kites, wire, reels, and sextant for the study of wind pressure" and, again, "kites, etc., for the study of temperature and wind at moderate elevations," as supplementary to balloons and mountain stations. But the important stimulus was given to this kite work by Eddy at Bayonne, N. J., in 1890, and just at this opportune moment Hargarve, in 1893, at Sydney, Australia, contributed to the progress of science his unique and valuable cellular kite, a full account of which was read at the Columbian Exposition, Chicago, 1893. Since then Eddy's work has been carried forward at Blue Hill by Mr. Rotch and his assistants, while

Hargrave's work has been taken up at Washington under Professor Moore's instructions and perfected by Potter and Marvin. At the same time the Germans have been busy developing a combination balloon and kite, powerful enough to carry up an officer for the purpose of military reconnaissances. Each successive decade of this century has witnessed a series of personal experiments in Europe and America, until now, just as the European meteorological bureaus have taken up the sounding balloon as a means of exploration to great vertical altitudes, the United States Weather Bureau has prepared kites to cover a great horizontal extent of territory with automatic meteorological instruments. The American system of kite work contemplates regular daily records with kites at about 5,000 feet altitude, while the European system is designed for special occasional work at 50,000 feet altitude. Undoubtedly each will supplement the other.

FURTHER COMMENT IS UNNECESSARY.

The Weather Bureau notes articles in two Boston papers, The Happy Thought, March 20, and The Transcript, April 28, which purport to be reports of papers read by the Director and staff of the Blue Hill Observatory before the Boston Scientific Society. The animus of these papers is to eulogize unduly the original work of that observatory at the expense of the United States Weather Bureau. The Blue Hill Observatory is entitled to much credit for its contributions to science, and its Director deserves all praise for his zeal in the advancement of meteorology, but we regret to say that several statements in the above articles are very misleading and incorrect, as shown by well known facts in the history of the National Service. If the Director of the Blue Hill Observatory thinks it necessary to thus magnify his own work, we respectfully suggest that it be done in such a way as to be above the criticism of his friends.

METEOROLOGICAL TABLES.

By A. J. HENRY, Chief of Division of Records and Meteorological Data.

Table I gives, for about 130 Weather Bureau stations making two observations daily and for about 20 others making only the 8 p. m. observation, the data ordinarily needed for climatological studies, viz, the monthly mean pressure, the monthly means and extremes of temperature, the average conditions as to moisture, cloudiness, movement of the wind, and the departures from normals in the case of pressure, temperature, and precipitation; the altitudes of the instruments, the total depth of snowfall, and the mean wet-bulb temperatures are now given.

Table II gives, for about 2,400 stations occupied by voluntary observers, the extreme maximum and minimum temperatures, the mean temperature deduced from the average of all the daily maxima and minima, or other readings, as indicated by the numeral following the name of the station; the total monthly precipitation, and the total depth in inches of any snow that may have fallen. When the spaces in the snow column are left blank it indicates that no snow has fallen, but when it is possible that there may have been snow of which no record has been made, that fact is indicated by leaders, thus (. . . .).

Table III gives, for about 30 Canadian stations, the mean pressure, mean temperature, total precipitation, prevailing wind, total depth of snowfall, and the respective departures from normal values. Reports from Newfoundland and Bermuda are included in this table for convenience of tabulation.

Table IV gives detailed observations at Honolulu, Republic of Hawaii, by Curtis J. Lyons, meteorologist to the Government Survey.

Table V gives, for 26 stations, the mean hourly temperatures deduced from thermographs of the pattern described and figured in the Report of the Chief of the Weather Bureau, 1891–'92, p. 29.

Table VI gives, for 26 stations, the mean hourly pressures as automatically registered by Richard barographs, except for Washington, D. C., where Foreman's barograph is in use. Both instruments are described in the Report of the Chief of the Weather Bureau, 1891–'92, pp. 26 and 30.

Table VII gives, for about 130 stations, the arithmetical means of the hourly movements of the wind ending with the respective hours, as registered automatically by the Robinson anemometer, in conjunction with an electrical recording mechanism, described and illustrated in the Report of the Chief of the Weather Bureau, 1891–'92, p. 19.

Table VIII gives, for all stations that make observations at 8 a. m. and 8 p. m., the four component directions and the resultant directions based on these two observations only and without considering the velocity of the wind. The total movement for the whole month, as read from the dial of the Robinson anemometer, is given for each station in Table I. By adding the four components for the stations comprised in any geographical division one may obtain the average resultant direction for that division.

Table IX gives the total number of stations in each State from which meteorological reports of any kind have been received, and the number of such stations reporting thunderstorms (T) and auroras (A) on each day of the current month.

Table X gives, for 56 stations, the percentages of hourly sunshine as derived from the automatic records made by two essentially different types of instruments, designated, respectively, the thermometric recorder and the photographic recorder. The kind of instrument used at each station is indicated in the table by the letter T or P in the column following the name of the station.

Table XI gives a record of rains whose intensity at some period of the storm's continuance equaled or exceeded the following rates:

Duration, minutes..	5	10	15	20	25	30	35	40	45	50	60	80	100	120
Rates pr. hr. (ins.)..	3.00	1.80	1.40	1.20	1.08	1.00	0.94	0.90	0.86	0.84	0.75	0.60	0.54	0.50

In the northern part of the United States, especially in the colder months of the year, rains of the intensities shown in the above table seldom occur. In all cases where no storm of sufficient intensity to entitle it to a place in the full table has occurred, the greatest rainfall of any single storm has been given, also the greatest hourly fall during that storm.

Table XII gives the record of excessive precipitation at all stations from which reports are received.

NOTES EXPLANATORY OF THE CHARTS.

Chart I.—Tracks of centers of high pressure. The roman letters show number and order of centers of high areas. The figures within the circles show the days of the month; the letters *a* and *p* indicate, respectively, the 8 a. m. and 8 p. m., seventy-fifth meridian time, observations. The queries (?) on the tracks show that the centers could not be satisfactorily located. Within each circle is given the highest barometric reading reported near the center. A blank indicates that no reports were available. A wavy line indicates the axis of a ridge of high pressure.

Chart II.—Tracks of centers of low pressure. The roman letters show number and order of centers of low areas. The